In the Claims

Please cancel claims 7-9 without prejudice.

Please amend claims 1, 3 and 19 as follows, wherein any additions to the claims are underlined and any deletions are set forth in brackets or as struckthrough text.

1. (Currently Amended) A thin film thickness measurement apparatus comprising:

a light source;

[[an]] a first optical fiber;

a plurality of additional optical fibers arranged around the first optical fiber;

a light receiving unit for directing light from said light source substantially perpendicular to a substrate and for receiving light reflected from said substrate; and

an analyze unit for analyzing thickness of a thin film of said substrate according to intensity of reflected light received by said light receiving unit, wherein

(a) the first optical fiber guides the light from said light source onto said substrate, and

(b) at least one of the plurality of additional optical fibers guides the reflected light from said substrate to said analyze unit.

2. (Canceled)

3. (Currently Amended) The thin film thickness measurement apparatus according to claim [[2]] 3, wherein said first optical fiber is a branch type optical fiber guiding light from said light source to a plurality of sites on said substrate, and receiving light reflected from said plurality of sites, said thin film thickness measurement apparatus further comprising

a shutter selectively blocking the plurality of reflected light received by said branch type first optical fiber.

4. (Original) The thin film thickness measurement apparatus according to claim 3, said analyze unit including

a spectroscope dividing reflected light from said substrate according to intensity of each wavelength, and

a calculation unit calculating thickness of a thin film of said substrate according to intensity of each wavelength divided by said spectroscope.

5. (Original) The thin film thickness measurement apparatus according to claim 4, wherein said calculation unit calculates thickness of said thin film by equations of:

$$R = \frac{R(2,1) + R(1,0) \times k^2 + 2 \times \rho(2,1) \times \rho(1,0) \times k \times \cos(\gamma)}{1 + R(2,1) + R(1,0) \times k^2 + 2 \times \rho(2,1) \times \rho(1,0) \times k \times \cos(\gamma)}$$

$$\rho(2,1) = \frac{n_1 - n_2}{n_1 + n_2}$$

$$\rho(1,0) = \frac{n_0 - n_1}{n_0 + n_1}$$

$$R(2,1) = \rho(2,1)^2$$

$$R(1,0) = \rho(1,0)^2$$

$$\gamma = 4\pi n_1 d/\lambda$$

where n_0 is a refractive index of said substrate, n_1 is a refractive index of said thin film, n_2 is a refractive index of air, λ is a wavelength of light, and k is an absorption coefficient of said thin film.

6. (Original) The-thin film thickness measurement apparatus according to claim 4, wherein said calculation unit calculates thickness of said thin film by equations of:

$$R(p+1, 0) = \frac{A+B}{1+C+B}$$

$$A = R(p+1, p)+R(p, 0)\times k^2$$

$$B = 2\times \rho(p+1, p)\times \sqrt{R(p, 0)}\times k\times \cos(\gamma(p, 0)+\gamma(p))$$

$$C = R(p+1, p)\times R(p, 0)\times k^2$$

$$\rho(p+1, p) = \frac{n(p)-n(p+1)}{n(p)+n(p+1)}$$

$$R(p+1, p) = \rho(p+1, p)^2$$

$$\tan\gamma(p, 0) = \frac{D}{E+F}$$

$$D = \sqrt{R(p-1, 0)}\times(1-\rho(p, p-1)^2)\times \sin(\gamma(p-1, 0)+\gamma(p-1))$$

$$E = \rho(p, p-1)\times(1+R(p-1, 0))$$

$$F = \sqrt{R(p-1, 0)\times(1+\rho(p, p-1)^2)\times \cos(\gamma(p-1, 0)+\gamma(p-1))}$$

$$\gamma(p) = 4\pi n(p)d(p)\cos\theta(p)/\lambda$$

where n_0 is a refractive index of said substrate, n(p) is a refractive index of the p-th layer of thin film from said substrate, n(p+1) is a refractive index of air, λ is a wavelength of light, and k is an absorption coefficient of said p-th layer of thin film.

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Original) The thin film thickness measurement apparatus according to claim 1, said analyze unit including

a spectroscope dividing reflected light from said substrate according to intensity of each wavelength, and

a calculation unit calculating thickness of a thin film of said substrate according to intensity of each wavelength divided by said spectroscope.

11. (Original) The thin film thickness measurement apparatus according to claim 10, wherein said calculation unit calculates thickness of said thin film by equations of:

$$R = \frac{R(2,1) + R(1,0) \times k^2 + 2 \times \rho(2,1) \times \rho(1,0) \times k \times \cos(\gamma)}{1 + R(2,1) + R(1,0) \times k^2 + 2 \times \rho(2,1) \times \rho(1,0) \times k \times \cos(\gamma)}$$

$$\rho(2,1) = \frac{n_1 - n_2}{n_1 + n_2}$$

$$\rho(1,0) = \frac{n_0 - n_1}{n_0 + n_1}$$

$$R(2,1) = \rho(2,1)^2$$

$$R(1,0) = \rho(1,0)^2$$

$$\gamma = 4\pi n_1 d/\lambda$$

where n_0 is a refractive index of said substrate, n_1 is a refractive index of said thin film, n_2 is a refractive index of air, λ is a wavelength of light, and k is an absorption coefficient of said thin film.

12. (Original) The thin film thickness measurement apparatus according to claim 11, wherein said light receiving unit directs light substantially perpendicular to a substrate placed on a robot hand.

13. (Original) The thin film thickness measurement apparatus according to claim 11, wherein said light receiving unit is installed in a neighborhood of an outlet of a gate valve of a film growth apparatus.

14. (Original) The thin film thickness measurement apparatus according to claim 10, wherein said calculation unit calculates thickness of said thin film by equations of:

$$R(p+1, 0) = \frac{A+B}{1+C+B}$$

$$A = R(p+1, p)+R(p, 0)\times k^2$$

$$B = 2\times \rho\,(p+1, p)\times \sqrt{R(p, 0)}\times k\times \cos(\gamma(p, 0)+\gamma(p))$$

$$C = R(p+1, p)\times R(p, 0)\times k^2$$

$$\rho\,(p+1, p) = \frac{n(p)-n(p+1)}{n(p)+n(p+1)}$$

$$R(p+1, p) = \rho\,(p+1, p)^2$$

$$\tan\gamma\,(p, 0) = \frac{D}{E+F}$$

$$D = \sqrt{R(p-1, 0)}\times(1-\rho(p, p-1)^2)\times\sin(\gamma(p-1, 0)+\gamma(p-1))$$

$$E = \rho\,(p, p-1)\times(1+R(p-1, 0))$$

$$F = \sqrt{R(p-1, 0)\times(1+\rho(p, p-1)^2)\times\cos(\gamma(p-1, 0)+\gamma(p-1))}$$

$$\gamma\,(p) = 4\pi n(p)d(p)\cos\theta(p)/\lambda$$

where n_0 is a refractive index of said substrate, n(p) is a refractive index of the p-th layer of thin film from said substrate, n(p+1) is a refractive index of air, λ is a wavelength of light, and k is an absorption coefficient of said p-th layer of thin film.

15. (Original) The thin film thickness measurement apparatus according to claim 14, wherein said light receiving unit directs light substantially perpendicular to a substrate placed on a robot hand.

16. (Original) The thin film thickness measurement apparatus according to claim 14, wherein said light receiving unit is installed in a neighborhood of an outlet of a gate valve of a film growth apparatus.

17. (Original) The thin film thickness measurement apparatus according to claim 1, wherein said light receiving unit directs lights substantially perpendicular to a substrate placed on a robot hand.

18. (Original) The thin film thickness measurement apparatus according to claim 1, wherein said light receiving unit is installed in a neighborhood of an outlet of a gate valve of a film growth apparatus.

19. (Currently Amended) A thin film thickness measurement method comprising the steps of:

providing a first optical fiber and a plurality of additional optical fibers, wherein the plurality of additional optical fibers are arranged around the first optical fiber;

directing light substantially perpendicular to a substrate via [[an]] the first optical fiber;

receiving light reflected from said substrate via at least one of the plurality of optical fibers ~~said optical fiber~~; and

analyzing thickness of a thin film of said substrate according to intensity of said received reflected light.

20. (Original) The thin film thickness measurement method according to claim 19, wherein said step of measuring thickness of said thin film includes the steps of

dividing reflected light from said substrate according to intensity of each wavelength, and

calculating thickness of a thin film of said substrate according to said intensity of each wavelength divided.

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